

DESCRIPTION OF *PEMBATOXON INSULARE* GEN. N., SP. N. FROM PEMBA ISLAND (MOLLUSCA PULMONATA, UROCYCLIDAE)

By JACKIE VAN GOETHEM

INTRODUCTION

FROM previous work on slugs of the family Urocyclidae, it appears that the lack of a stimulatory organ (*diverticulum atrii*, *stylophorus* or *sarcobelum*) in different species cannot be the peremptory argument for uniting them in a single genus. For example, in a recent revision of the group (Van Goethem, in press) it was clearly demonstrated that three species formerly united in a single genus, *Atoxon* Simroth 1888, could be divided into two groups on the basis of a wide variety of morphological characters. These groups have been recognized as separate genera; the first includes *Atoxon fasciatum* Verdcourt 1965, while the second is represented by *Atoxon meridionale* Forcart 1967 and *Atoxon bruggeni* Forcart 1967.

The specimens described below certainly represent a new species and though it lacks a stimulatory organ, it cannot be included in any described genus (e.g. *Atoxon*). A new taxon is, therefore, described here.

Abbreviations used in text : h. height ; M median tooth of radula ; lg. length ; w. width.

SYSTEMATICS

PEMBATOXON gen. n.*

TYPE SPECIES : *Pembatoxon insulare* sp. n.

DIAGNOSIS : Tail long and strong, with visceral cavity extending to its posterior end. Mantle posteriorly completely fused to the cephalopodium; covering an internal shell; mantle aperture present, forming a small, medio-dorsal slit at the posterior end of the mantle. Shell unguiform, presenting a more or less bilateral symmetry; nucleus at the posterior end, medially; protoconch oval. Jaw strongly arcuate, with a median projection on the ventral margin. Radula with median and laterals tricuspid; marginals lacking the endocone, bicuspid (some main marginals unicuspid, the ectocone being reduced or lacking), very slender, much longer than the laterals; mesocone of the marginals extending far beyond the posterior margin of the basal tooth plate. Pulmonary cavity little vascularized; heart transverse; aorta divided in two branches immediately after leaving the ventricle. Reproductive system: epiphallus with a small bursa calcifera and a long tubular caecum; hermaphrodite gland situated well behind the albumen gland, in the middle part of the tail; stimulatory organ absent; penis long, with

* *Pembatoxon* results from the contraction of *Pemba* and *Atoxon*.

a spiral torsion; penial sheath only near the proximal end separated from the penial tube; penial papilla simple, very small; praeputium very short; vagina absent; epiphallus 2, very short. Spermatophore helicoid, without an angle; presenting scaly spines over about its whole length; top blunt; filiform part very short. Alimentary tract forming 3 loops (intestine with one forwardly directed loop) and presenting a spiral torsion. Retractor muscles: the right upper tentacular retractor passes over the proximal end of the penis.

Pembatoxon insulare sp. n.

TYPE LOCALITY. Pemba Island, E. Africa.

GEOGRAPHICAL DISTRIBUTION. Only from the type locality.

MATERIAL. Pemba Island, E. Africa. Collected by C. Crossland, 1901. Material in British Museum (Natural History): holotype (Reg. No. 1909.5.10.52) and 5 paratypes (Reg. No. 1909.5.10.53-57).

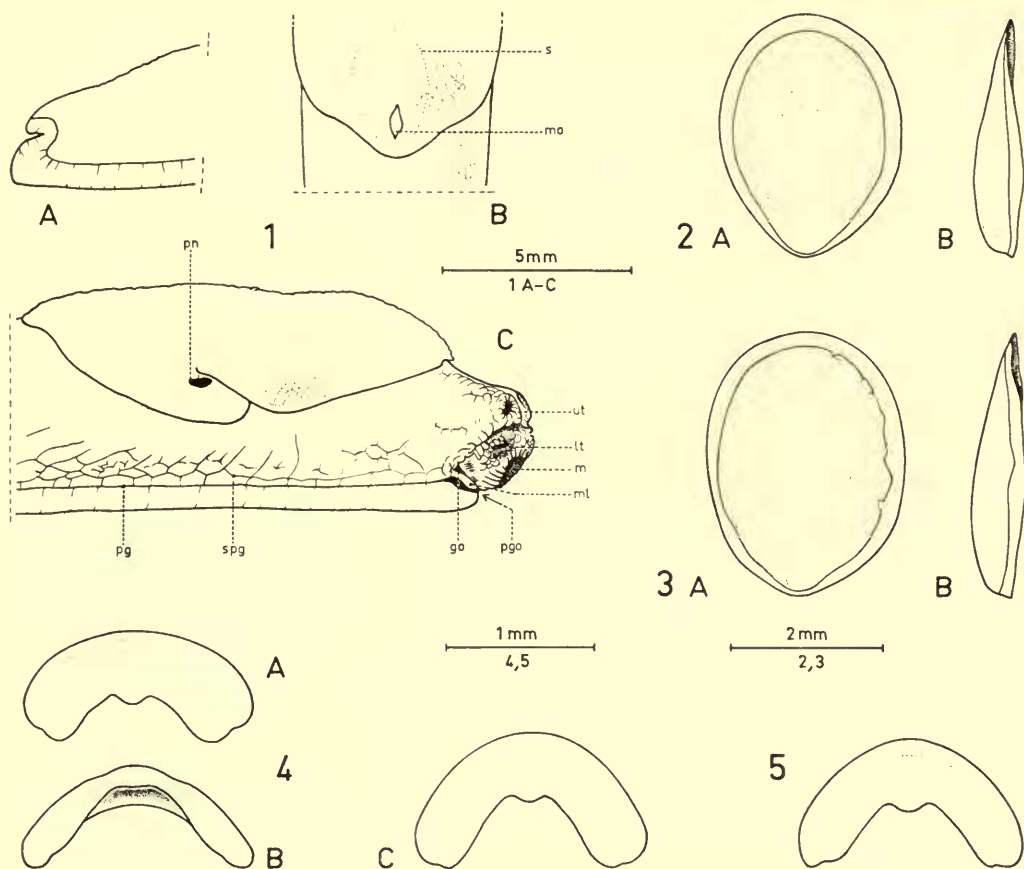
MEASUREMENTS. (in mm)

	Holotype	Paratype (1909.5.10.54)	Paratype (1909.5.10.55)
Body length	28.5	28.5	29.5
Body width at middle	5.5	6	6
Tail length	15	15.5	16.5
Mantle length	11.5	11.5	11.5
Mantle width at middle	9.5	10	10.5
Distance between respiratory orifice and anterior mantle margin	6.5	6.5	6.5
Length of respiratory orifice	0.5	0.7	0.5
Distance between respiratory orifice and posterior mantle margin	4.5	4.3	4.5
Height: maximum	6	6.5	6.5
at proximal end of tail	5	5.5	5.5
at posterior end of tail	2	2.5	2
Sole length	27	28.5	29
Sole width	2.8	3.5	3.5
Mid-area width of sole	1.0	1.2	1.2
Length of mantle aperture	0.8	0.7	0.8
Width of mantle aperture	0.4	0.2	0.2
Distance between mantle aperture and posterior mantle margin	0.7	0.6	0.8

DESCRIPTION.

External characters (Pl. 1, fig. 1-2; Fig. 1A-C)

Small slug with an adult length of c. 28 mm (in alcohol). Genital opening situated just behind and beneath the right lower tentacle, above the right anterior angle of the sole and just above the right mouth lobe. Tail long and well developed; its posterior end, at caudal gland level, slightly laterally compressed; not keeled; tapering backwards and ending in a well developed caudal horn (Fig. 1A); with fine longitudinal grooves (irregular on the dorsal part) limiting small polygonal tubercles and running to a fine irregular suprapedal groove. The latter being connected to the



FIGS 1-5. *Pembatoxon insulare* gen. n., sp. n.

Fig. 1. Holotype; A: Caudal end of the tail, lateral view; B: Posterior part of the mantle, dorsal view; C: Anterior part of the body, lateral view.

Fig. 2. Shell, holotype; A: Dorsal view; B: Lateral view.

Fig. 3. Shell, paratype 1909.5.10.53; A: Dorsal view; B: Lateral view.

Fig. 4. Jaw, holotype; A: Frontal view; B: Ventral view; C: Semi-frontal view.

Fig. 5. Jaw, paratype 1909.5.10.53, semi-frontal view.

(go, genital opening; lt, lower tentacle; m, mouth; ma, mantle aperture; ml, mouth lobe; pg, pedal groove; pgo, pedal gland opening; pn, pneumostome; s, shell; spg, suprapedal groove; ut, upper tentacle)

pedal groove by fine vertical grooves. Caudal aperture running to the posterior end of the sole. Mantle finely and very distinctly granulated. Mantle aperture small, slit like (Fig. 1B). Respiratory orifice, see Fig. 1C. Sole rather narrow. *Colour* (in alcohol): ground colour sandy; on the tail with a brown lateral stripe and a very fine, yellowish, medio-dorsal line (holotype); the ventral half of the tail, vaguely brown mottled. Posterior half of mantle with a trace of a brown lateral stripe. Sole unicoloured. Paratypes (1905.5.10.53, 56-57) sandy, unicoloured.

Shell (Figs 2-3)

Ovate, rather convex, concentrically striate, very thin, whitish. Nucleus raised, median, posterior, white. Periostracum pale yellow.

Holotype, lg. 3.2 mm; w. 2.4 mm; h. 0.6 mm.

Paratype (1909.5.10.53), lg. 3.5 mm; w. 2.6 mm; h. 0.7 mm.

Paratype (1909.5.10.55), lg. 3.6 mm; w. 2.8 mm; h. 0.7 mm.

Jaw (Figs 4-5)

Strongly arcuate, with a rounded median projection on the ventral margin.

Holotype, w. 1.6 mm; lg. 0.5 mm.

Paratype (1909.5.10.53), w. 1.5 mm; lg. 0.5 mm.

Paratype (1909.5.10.55), w. 1.7 mm; lg. 0.6 mm.

Radula (Figs 6-8)

Holotype (Fig. 6), formula: $(51+3+14+M+-) \times 124$. There is a rather distinct transition between laterals and marginals; only 3 transitional teeth; median tooth slightly asymmetrical. Median and laterals tricuspid. Marginals without endocones, very slender, with a high mesoconal supporting ridge; main marginals (teeth 25-40) very long, with generally a reduced ectocone (posterior margin of the basal tooth plate not reaching half the tooth length. Only c. 4 irregular teeth, with a blunt mesocone and several ectocones; generally 1 rudimental tooth. Size: 3.1×1.3 mm; c. 43 transversal rows/mm; length of M: 32-35 μ m.

Paratype (1909.5.10.53) (Fig. 7), formula: $(53+2+16+M+-) \times 130$. Endocone lacking from the 20th-21st tooth onwards. Most marginals between 20th and 42nd without an ectocone (unicuspid). Only c. 4 irregular teeth; generally 1 rudimental tooth. Size: 3.4×1.5 mm; c. 39 transversal rows/mm; length of M: 34-37 μ m.

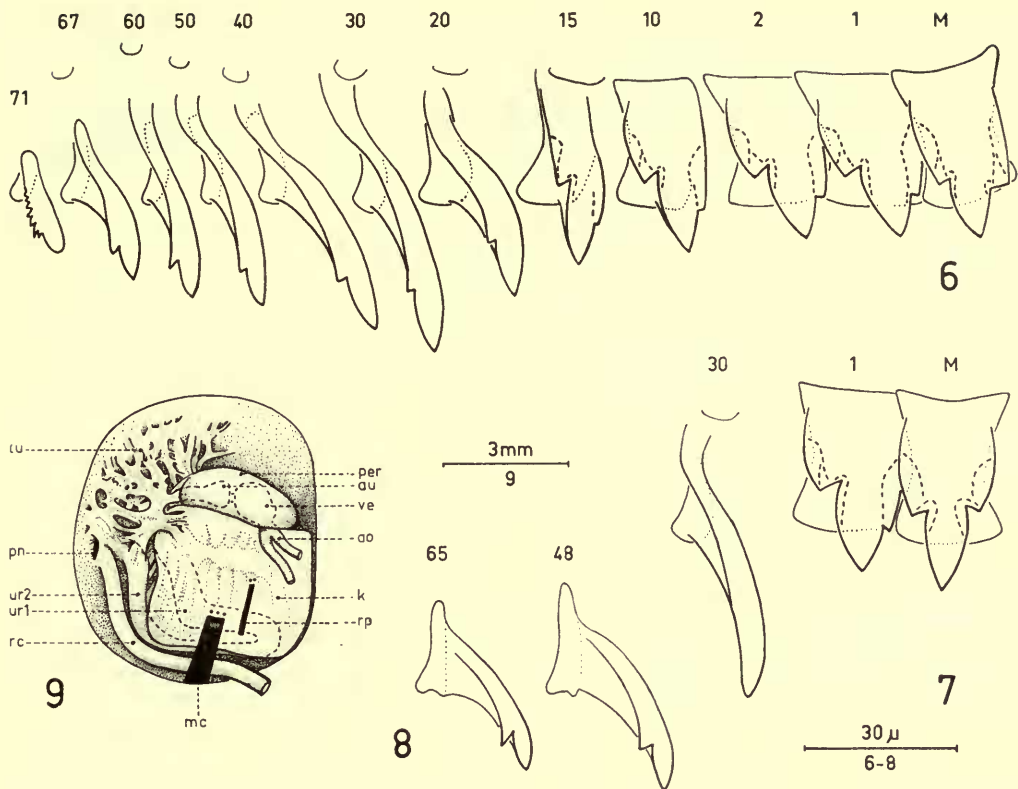
Paratype (1909.5.10.55) (Fig. 8), formula: $(60+3+16+M+-) \times 127$. Endocone lacking from the 22nd-23rd tooth onwards. Most marginals between 27th and 43rd without an ectocone (unicuspid). Mesoconal supporting ridge of marginals illustrated in Fig. 8. Only 4-5 irregular teeth; generally 1 rudimental tooth. Size: 3.3×1.5 mm; c. 39 transversal rows/mm; length of M: 34-37 μ m.

Pallial organs (Fig. 9)

Pulmonary cavity little vascularized. Kidney quadrangular. Heart transverse. Aorta divided into two branches immediately after leaving the ventricle; the anterior branch curving round the anterior loop of the intestine.

Reproductive system (Figs 10-13)

Holotype (Figs 10A-C, 11): Hermaphrodite gland (*ovotestis*) yellowish white, long and slender, with a weak torsion, situated in the middle part of the tail. Hermaphrodite duct (*ductus hermaphroditicus*) rather long, convoluted proximally. Albumen gland (*glandula albuminalis*) strongly developed, its middle part situated on a level with the posterior mantle margin. Common duct (*spermoviductus*) short,



FIGS 6-9. *Pembatoxon insulare* gen. n., sp. n.

Fig. 6. Radula, holotype.

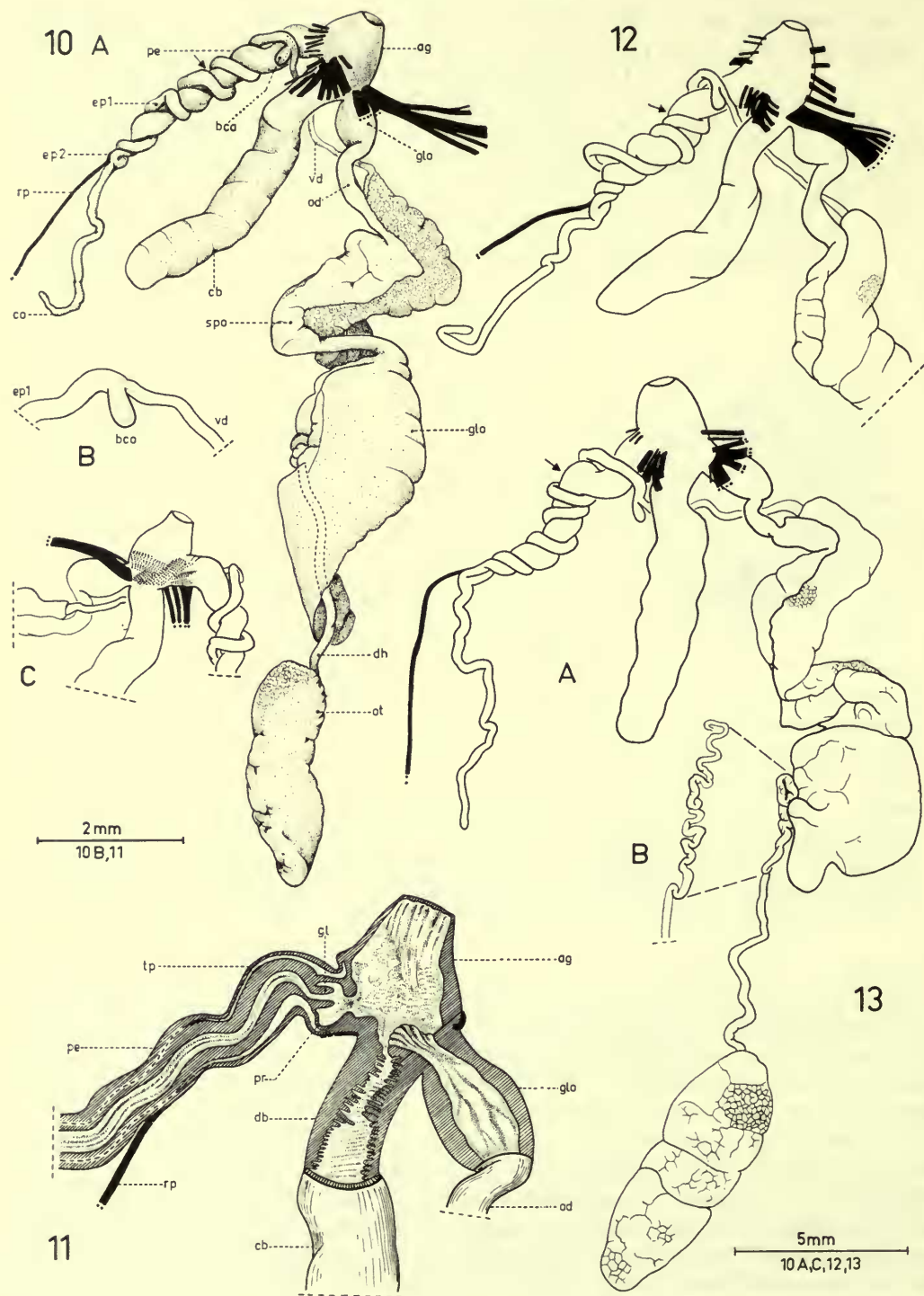
Fig. 7. Radula, paratype 1909.5.10.53.

Fig. 8. Two marginal teeth in almost lateral view, paratype 1909.5.10.55.

Fig. 9. Pallial organs, ventral view, holotype.

(ao, aorta; au, auricle; k, kidney; lu, lung (roof of pulmonary cavity); mc, columellar retractor muscle; per, pericardium; pn, pneumostome; rc, rectum; rp, penial retractor muscle; ur 1, primary ureter; ur 2, secondary ureter; ve, ventricle)

voluminous. *Vas deferens* short, passing under the spermathecal duct. Epiphallus with a small, ovoid *bursa calcifera* (Fig. 10B) at its distal end, and a tubular *caecum* (6.2 mm long) near its proximal end. Epiphallus 1, 12.5 mm long, wound around the penis and epiphallus 2 over its whole length. The latter very short (1.2 mm). Penis tubular, thick-walled, spirally torsive, clearly thicker than the epiphallus. Penial sheath (*tunica penis*) individualized at the proximal part of the penis (Fig. 11). Prepuce (*praeputium*) very short, separated from the genital atrium by a thick ring-wall. Penial papilla (*glans penis*) simple, very small (c. 0.25 mm long). Penial retractor muscle (*retractor penis*) very thin, long, arising from the left side of the diaphragm near the posterior margin of the kidney (Fig. 9), slightly adhered to the inner side of the penis windings and ending at about the distal end of the penial sheath (Fig. 10A, indicated by a small arrow; Fig. 11). Oviduct (*oviductus*)



very short. Oviduct gland (*glandula oviductus*) ovoid, with 4-5 rounded, well-developed irregular folds. Spermatheca (*bursa copulatrix*) consisting of a long, slender sac (*corpus bursae*), and a short, wide duct (*ductus bursae*), internally with numerous high, narrow folds; containing 2 spermatophores. *In situ*, the end of the spermathecal sac situated ventrally, on the same level as the insertion of the columnellar retractor muscle. Atrium (*atrium genitale*) well developed, with numerous retractor muscles: at the issue of the oviduct gland, 3 long and strong ventral retractor bundles inserting at the left side of the foot-sole (on a level with the lung) and at the ventral side of the left body wall; at the issue of the penis and between penis and spermatheca several retractor muscles inserting at the right body wall. The ventral side of the atrium shows strong muscles (Fig. 10C, stipplings).

Paratype (1909.5.10.53) (Fig. 13A-B): Albumen gland quadrangular with a terminal lobe on the left side. Vas deferens wider at its distal end. The first section of the epiphallus, 14.5 mm long. Caecum, 9.0 mm long. Penis: distal end of penial sheath (indicated by a small arrow, Fig. 13A) is coincident with the insertion point of penial retractor muscle. Penial papilla very small, smaller than in the holotype, very near to the penial opening. Spermatheca containing a spermatophore.

Paratype (1909.5.10.55) (Fig. 12): Vas deferens a little wider at its distal end. The first section of the epiphallus, 13.5 mm long. Caecum, 8.0 mm long. Penis: distal end of penial sheath and insertion point of penial retractor muscle indicated by a small arrow on Fig. 12. Penial papilla not distinct; however, a small lobe can possibly be interpreted as a penial papilla.

Spermatophore (Pl. I, figs 3-4; Fig. 14A-I)

Holotype (Fig. 14A-I): Helicoid, with 6 windings. Length: *c.* 16.5 mm. Apex blunt, rounded. Only the apical part of the spermatophore (for nearly 1 mm) smooth. Outer side of the whorls with 4-5 irregular rows of forwardly directed scaly spines, each spine about 0.1 mm long. Posteriorly the number of rows decreases. Filiform section of the spermatophore, very short (*c.* 1.4 mm), with 1 sharp ridge (Fig. 14A, H) and 1 row of forwardly directed denticles (Fig. 14A, G, I), each denticle about 80-90 μ m long. Terminal opening present. A

FIGS 10-13. *Pembatoxon insulare* gen. n., sp. n.

Genitalia. Fig. 10. Holotype; A: General view; B: Detail of *bursa calcifera*; C: Ventral view of atrium and adjacent organs.

Fig. 11. Holotype, longitudinal section of atrium and adjacent organs.

Fig. 12. Paratype 1909.5.10.53.

Fig. 13. Paratype 1909.5.10.53: A: General view; B: Detail proximal part of hermaphrodite duct, partly unrolled.

(ag, *atrium genitale* (genital atrium); bca, *bursa calcifera*; ca, *caecum*; cb, *corpus bursae* (spermathecal sac); db, *ductus bursae* (spermathecal duct); dh, *ductus hermaphroditicus* (hermaphrodite duct); ep 1,2, *epiphallus* 1,2; gl, *glans penis* (penial papilla); gla, *glandula albuminalis* (albumen gland); glo, *glandula oviductus* (oviduct gland); od, *oviductus* (oviduct); ot, *ovotestis* (hermaphrodite gland); pe, penis; pr, *praeputium* (prepuce); rp, *retractor penis* (penial retractor muscle); spo, *spermoviductus* (common duct); tp, *tunica penis* (penial sheath); vd, *vas deferens*).

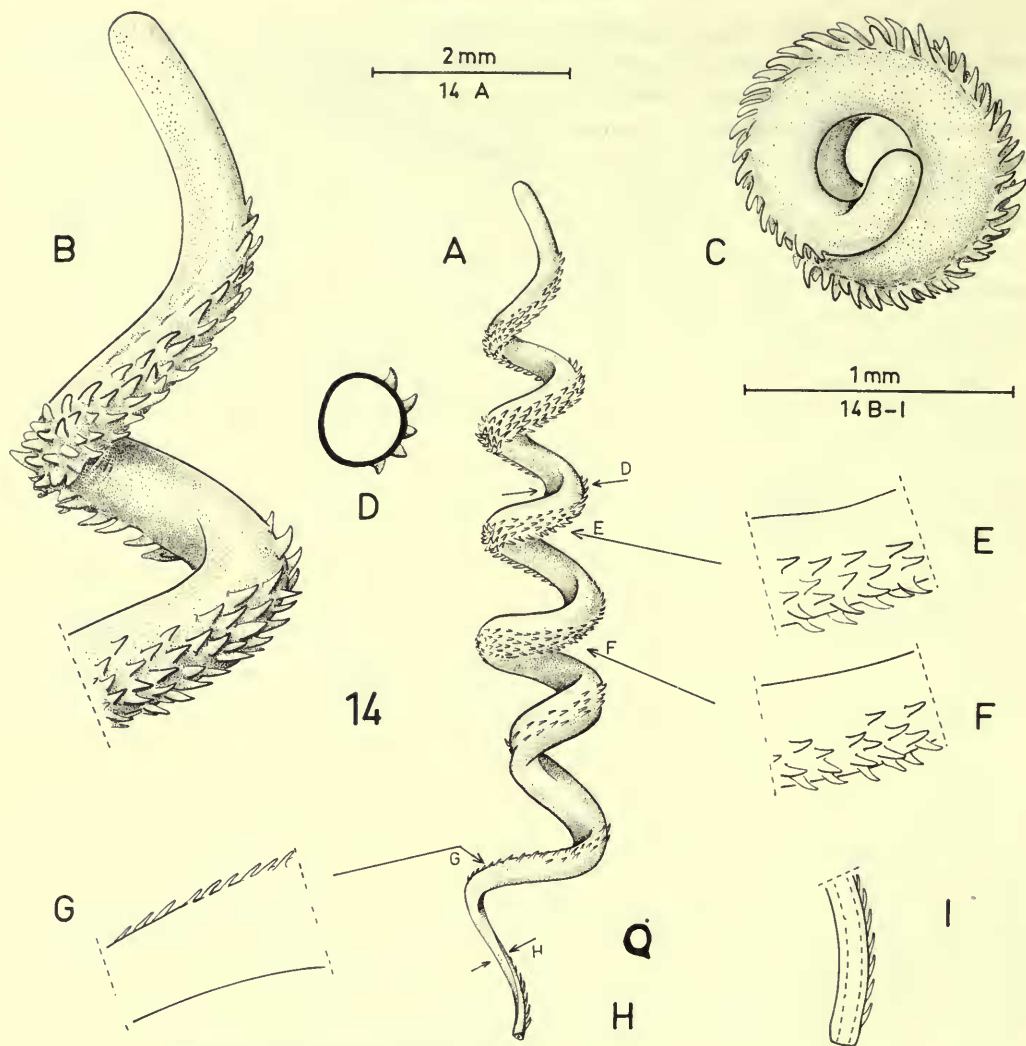


FIG. 14A-I. *Pembatoxon insulare* gen. n., sp. n.

Spermatophore, holotype. A: General view; B: Detail apical part, lateral view; C: Detail apical part, dorsal view; D: Transversal section at D in Fig. 14A; E: Detail of spines at E in Fig. 14A; F: Detail of spines at F in Fig. 14A; G: Detail of denticles at G in Fig. 14A; H: Transversal section at H in Fig. 14A; I: Detail terminal end.

second spermatophore, with the median area partially digested, measures *c.* 16 mm in length (the filiform part being *c.* 1.4 mm).

Paratype (1909.5.10.53) (Pl. 1, figs 3-4): Length: *c.* 16 mm (the filiform part measuring *c.* 1.5 mm).

Visceral organs

Visceral cavity extending to the posterior end of the tail. Alimentary tract forming 3 loops (intestine with one forwardly directed loop), presenting together

nearly a complete circumvolution. Posterior tip of the hermaphrodite gland extending behind the first loop of the alimentary tract. Anterior tip of the digestive gland extending to the inner side of the forwardly directed intestinal loop. Rectum passing above the basal part of the columellar retractor muscle (Fig. 9, ventral view).

Retractor muscles

The right upper tentacular retractor passes over the proximal end of the penis. Retractor muscles of the genitalia, see above.

DISTINGUISHING FEATURES OF THE GENUS AND SPECIES

Pembatoxon gen. n. resembles the genus *Atoxon* Simroth, 1888, in the absence of a stimulatory organ, but differs from that genus in :

1. the spermatophore having a very short filiform section ; a blunt, rounded apex and numerous forwardly directed spines over almost the whole length of the fusiform part ;
2. the penis having a short penial sheath and a very small penial papilla ;
3. the atrium having retractor muscles inserting at the left side of the foot-sole and at the ventral side of the left body wall ;
4. the absence of a vagina ;
5. the radula with relatively smaller number of laterals in comparison with the number of marginals.

Pembatoxon insulare gen. n., sp. n. differs from *Atoxon fasciatum* Verdcourt, 1965 (classified in a new genus, see J. Van Goethem in press) in :

1. the form of the spermatophore (see above) ;
2. the penis with a spiral torsion ;
3. the very short epiphallus 2 ;
4. the absence of a vagina ;
5. the aorta divided in two branches immediately after leaving the ventricle ;
6. the radula with median and laterals not having a very long mesocone.

Pembatoxon insulare gen. n., sp. n. differs from *Atoxon meridionale* Forcart, 1967, and *Atoxon bruggeni* Forcart, 1967 (both species classified in a new genus, see J. Van Goethem, 1973) in :

1. the form of the spermatophore (see above) ;
2. the penis with a very small, simple penial papilla ;
3. the absence of a vagina ;
4. the radula with most of the marginals bicuspid ;
5. the right upper tentacular retractor passing over the proximal end of the penis.

ACKNOWLEDGEMENTS

I am grateful to Mr J. F. Peake for reading the manuscript, to Mrs J. Van Meldereren for tracing over the drawings in ink, to the Trustees of the British Museum (Natural

History) for the loan of the specimens and to the 'Komitee voor Elektronenmikroskopie van de vaste stof, Katholieke Universiteit Leuven' for enabling me to make the photographs of the spermatophore (Pl. 1, figs 3-4).

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